

## CLAIMS

We claim:

- 1           1. An elevator performance meter, comprising:
  - 2           an internal processor for controlling the functions of said
  - 3 elevator performance meter;
  - 4           a sensor for continuously monitoring and measuring the
  - 5 acceleration of an elevator and generating an analog voltage
  - 6 output signal;
  - 7           an anti-alias filter, positioned in direct communication
  - 8 with said sensor, for receiving the analog signal from said
  - 9 sensor and removing background noise from the signal;
  - 10          an analog to digital converter for receiving low-pass
  - 11 filtered data from said anti-alias filter and converting the
  - 12 filtered data into a digital numerical value and send the
  - 13 digital numerical value to said processor;
  - 14          a clock for providing an accurate time base for said
  - 15 internal processor;
  - 16          a power supply for providing power to said elevator
  - 17 performance meter;

18 a battery pack for providing battery power to said power  
19 supply;

20 a battery monitor for monitoring the level of power  
21 remaining in the battery pack and reporting a warning to said  
22 processor when the level of power remaining in said battery pack  
23 is lower than a predetermined limit;

24 an outer housing having a top surface, a bottom surface and  
25 a plurality of side portions for encasing said sensor, said  
26 anti-alias filter, said analog to digital converter, said clock,  
27 said power supply, said battery pack and said battery monitor in  
28 a single self contained enclosure;

29 a processor program embedded in said processor for  
30 analyzing the filtered data sent to said processor and for  
31 managing the functions of said elevator performance meter; and

32 a display unit for receiving the results of the analyzed  
33 data from said processor and displaying the results to the  
34 operator of the elevator performance meter in an alphanumeric  
35 format;

36 whereby said elevator performance meter measures the  
37 variations in the velocities, accelerations, jerk and run

38 durations of the elevator, analyzes the measurements and  
39 provides the results of the analysis to the operator of the  
40 performance meter in an easily understandable format.

1 2. The elevator performance meter according to claim 1, a  
2 data entry unit disposed along the top surface of said housing  
3 for entering operator menu selections into said processor.

1 3. The elevator performance meter according to claim 2,  
2 wherein said data entry unit is a keypad having a plurality of  
3 entry keys.

1 4. The elevator performance meter according to claim 1,  
2 wherein said display unit is an LCD readout screen.

1 5. The elevator performance meter according to claim 1,  
2 further comprising a padded carrying case adapted for receiving  
3 said housing, said case aiding in the level placement of said  
4 elevator performance meter on the floor of the elevator by

5 reducing uneven surface on the elevator floor that have an  
6 adverse affect of the accuracy of said elevator performance  
7 meter.

1 6. The elevator performance meter according to claim 1,  
2 further comprising a wire remote keypad device for allowing the  
3 operator to enter menu selections into said processor while  
4 standing up during the monitoring of the elevator, said keypad  
5 device comprising an elongate cord secured to said housing  
6 having a connecting end and a distal end, an input pad disposed  
7 on the distal end of said cord and a plurality of input keys  
8 disposed on said input pad.

1 7. The elevator performance meter according to claim 1,  
2 wherein said battery pack comprises four AA alkaline batteries.

1 8. The elevator performance meter according to claim 1,  
2 wherein said power supply comprises a plurality of electronic  
3 switches and inductors for creating precisely controlled power  
output voltages from the power supplied by said battery pack.

1        9.    The elevator performance meter according to claim 1,  
2 wherein said sensor is an accelerometer.

1        10.   The elevator performance meter according to claim 1,  
2 further comprising a processor external memory unit for  
3 supplying program data to said processor.

1        11.   The elevator performance meter according to claim 1,  
2 further comprising a mother board for accommodating said sensor,  
3 said processor, said anti-alias filter, said analog to digital  
4 converter, said clock, said batter monitor, said power supply,  
5 and said battery pack and a separate daughter board for  
6 accommodating said display unit.

1        12.   The elevator performance meter according to claim 1,  
2 wherein said processor program comprises:

1        a gravity filter sub-routine for determining a local  
2 gravity value and assigning that value a numerical constant;  
3  
4

5       a main sub-routine that manages all aspects of the elevator  
6 performance meter and receives the analyzed, filtered  
7 acceleration data and the local gravity value from said gravity  
8 filter and removes the local gravity value from said filter  
9 acceleration data;

10       a run filter sub-routine for receiving acceleration samples  
11 from said main sub-routine and removing background noise from  
12 the samples and delivering the samples back to said main sub-  
13 routine for further analysis; and

14       an internal run time memory unit for receiving analyzed  
15 data from said main sub-routine and storing the data.

1        13. A process for measuring the performance of an elevator  
2 comprising the steps of:

3        placing an elevator performance meter on the floor of an  
4 elevator to be tested and turning on the power of the meter;

5        the operator placing an elevator floor call to begin  
6 movement of the elevator;

7        continuously monitoring the raw acceleration of the  
8 elevator by an accelerometer enclosed in said meter and  
9 transferring measured raw acceleration data to an anti-alias  
10 filter;

11       removing background noise from the raw acceleration data  
12 caused by acceleration voltage aliases with an anti-alias filter  
13 and transferring a filtered data signal to an analog to digital  
14 converter;

15       converting the filtered data into a digital numerical  
16 signal and sending the digital signal to a processor;

17       analyzing and measuring the digital signal with a processor  
18 program and sending the results of the analysis and measurements  
19 to a display unit; and

20 displaying the results of the analysis and measurement on a  
21 display unit in an alphanumeric format.

1 14. The process according to claim 13, further comprising  
2 automatically calibrating the elevator performance meter prior  
3 to the operator entering in the elevator floor call.

1 15. The process according to claim 13, wherein said  
2 analyzing and measuring step comprises:

3 using a gravity filter to determine a local gravity value  
4 by analyzing a plurality of acceleration samples and assigning  
5 the local gravity value a numerical constant and transferring  
6 the local gravity value and the filter data signal to a main  
7 sub-routine in the processor program;

8 mathematically removing the local gravity value from said  
9 filtered data signal with the main sub-routine and transferring  
10 acceleration samples to a run filter sub-routine;

11 removing all background noise from the acceleration samples  
12 with the run filter sub-routine and returning the acceleration  
13 samples to the main sub-routine; and



14 continuously monitoring the acceleration samples with said  
15 main sub-routine to recognize various measurement points as they  
16 occur in real time.

1 16. The process according to claim 15, further comprising  
2 the step of dissecting the acceleration samples into eleven  
3 critical categories in real time as they occur and measuring the  
4 properties of each point by the main sub-routine.

1 17. The process according to claim 16, further comprising  
2 the step of displaying the measurements for each critical  
3 category separately on said display unit as they occur in real  
4 time.

1 18. The process according to claim 13, further comprising  
2 saving the results from the display unit in an internal run time  
3 memory.